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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,442	12/20/2001	Stephen W. Montgomery	884.425US1	1928

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EXAMINER

CHANG, YEAN HSI

ART UNIT PAPER NUMBER

2835

DATE MAILED: 08/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/027,442

Applicant(s)

MONTGOMERY ET AL.

Examiner

Yean-Hsi Chang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 23 June 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-2, 4-12, 14-16 and 20-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Tobita (US 2002/0090501 A1).

Tobita teaches a thermal interface structure comprising:

- An electronic assembly (fig. 5) comprising at least one IC package comprising at least one IC die (12, fig. 5) (claim 14)
- At least one carbon nanotube or a bundle of carbon nanotubes (carbon fiber 20, fig. 6, may be in the form of nanotubes, see page 2, [0029]) oriented substantially parallel to a desired heat transfer axis of the thermal interface (13, fig. 3; also see page 6, [0091]) (claims 1, 6, 9 and 14)
- An interstitial material (see page 4, [0053]) in which the nanotubes are embedded (claims 1, 6, 10 and 15)

- Wherein the structure has a first surface (lower surface of 13 shown in fig. 5, not numbered) to contact a surface of the circuit die (upper surface of 12, fig. 5) and a second surface (upper surface of 13 shown in fig. 5, not numbered) to contact a surface of a cooling solution (lower surface of 15, a heat sink, fig. 5), the first and second surfaces being substantially parallel to each other and perpendicular to the heat transfer path (see fig. 5) (claims 2, 8-9 and 14)
- Wherein the interstitial material is a polymeric material being selected from the group of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde (see page 3, [0042] – [0047]) (claims 4-5, 7, 11 and 16)
- Wherein the thermal interface structure (or a thermally conductive element) has a surface area that is substantially the same as the surface area of the die (shown in fig. 5) (claim 12)
- The method of fabricating a thermal interface structure and providing a thermal intermediate between two objects being taught in detail in the specification (claims 20-26)

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 3 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobita.

Tobita discloses the claimed invention except the thickness range of the thermal interface structure being different. It would have been an obvious matter to select a thickness range of the thermal interface structure being 5-20 microns (claim 3) or 10-50 microns (claim 13), since such a modification would have involved a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. MPEP §2144.04, IV. A.

5. Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schumann et al. (US 6,006,168) in view of Tobita.

Schumann teaches a data processing system comprising:

- A bus (PCI BUS, fig. 1) coupling components to the data processing system (claim 17)
- A display (included in I/O devices, fig. 1; see col.3, line 66 through col. 4, line 4) coupled to the bus (claim 17)
- An external memory (included in I/O devices, fig. 1; see col.3, line 66 through col. 4, line 4) coupled to the bus (claim 17)
- A processor (11, 12, 14, 16 and 18, fig. 1) coupled to the bus and comprising an electronic assembly (11 and 12, fig. 1) including at least one electronic package (11, fig. 1) (claim 17)

Schumann fails to teach the at least one electronic package comprising: at least one integrated circuit die, a heat sink, and a thermally conductive element coupled to the IC die and the heat sink, comprising a plurality of carbon nanotubes and an interstitial material interspersed among the nanotubes and the interstitial material being a polymeric material selected from the group consisting of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde.

Tobita teaches an electronic package comprising: one integrated circuit die, a heat sink, and a thermally conductive element coupled to the IC die and the heat sink, comprising a plurality of carbon nanotubes and an interstitial material interspersed among the nanotubes and the interstitial material being a polymeric material selected from the group consisting of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde as discussed in detail in paragraph 2, hereinabove.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Schumann with the electronic package taught by Tobita for the purpose of providing more efficient thermal interface structure.

Response to Arguments

6. Applicant's arguments regarding claim 1, filed 23 June 2003 have been fully considered but they are not persuasive. Applicant argues that Tobita does not disclose "at least one carbon nanotube", does not show "how to make and use a thermally

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conductive polymer sheet which comprises at least one carbon nanotube", and the orientation of the carbon nanotubes.

Tobita teaches that the graphitized carbon fibers may take the form of a nanotube (see page 2, [0029]), so the carbon fiber can be called carbon nanotube when it takes the form of a nanotube; the method of forming the device is not convincing as to the issue of patentability of the device itself, since the structure of the device is not changed (see MPEP §2113); and the orientation of the fibers is clearly stated in the abstract, shown in fig. 3, and stated in page 6, [0091].

7. Applicant's arguments with respect to claim 17 have been considered but are moot in view of the new ground(s) of rejection.

Correspondence

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yean-Hsi Chang whose telephone number is (703) 306-5798. The examiner can normally be reached on 07:30-16:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Darren Schuberg can be reached on (703) 308-4815. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-3431 for regular communications and for After Final communications. There are RightFAX numbers and provide the fax sender with an auto-reply fax verifying receipt by the USPTO: Before-Final (703-872-9318) and After-Final (703-872-9319).

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 305-8558.

Yean-Hsi Chang
Patent Examiner
Art Unit: 2835
August 4, 2003

A handwritten signature in cursive script, reading "Yean-Hsi Chang". The signature is written in black ink and is positioned below the typed name and date.